

Comments of
Virginia Institute of Marine Science
on the
Disposal of Spoil
from

Tangier Island Channel Dredging

December 9, 1976

Introduction

Tangier Island (in reality a group of islands which should more properly be called the Tangier Islands) is completely insular. In contrast to many other islands in the Chesapeake System, it is completely isolated physically from the mainland, and can only be reached bodily by water or air. The bulk of the food, and all other supplies and materials for the community must be brought in by boat. All wastes that are generated must be transported away by water, discarded on the marshland (which the entire island group is) where it remains visible or cast into the waters. Most of the families on the island are depended upon watering as a livelihood. Use of fishing boats is a necessity. Channels which will accommodate incoming vessels and fishing boats are essential to the survival of Tangier.

Tangier is unusual in another way. It is occupied by a sizable population which has been developing and surviving there since the late 1600's. It appears as though the human population will remain at about 900, possibly 1,000, for

some time to come. Hence the town, the county, the region, the state and the Federal Government must plan to continue to provide the services and assistance required to maintain such a community. .

One of the most important services rendered by government is facilitation of transportation. In the case of Tangier Island this means maintenance of adequate channels and the air strip. Maintenance of channels involves not only digging the necessary trenches in state-owned bottoms but disposal of the spoil taken from those trenches. Around Tangier, as in most places in the Chesapeake, sedimentation is rapid. Channels tend to fill in quickly and frequent maintenance dredging is the rule. It can be expected that both dredging and proper and effective dredge spoil disposal will be problems around Tangier for as long as there are people.

The Islands making up Tangier are low and marshy. There is little freeboard. They are all wetlands. (As an aside, indications are that accurate elevations have never been developed. If this is true, efforts must be made to rectify this lack. Accurate elevations are important!) The current rise in relative sea level, or subsidence-or both, diminishes what little freeboard there is.

Solid waste disposal and the disposal of sewage and commercial wastes have traditionally been disposed of in the wetlands, the guts, the creeks or in the shallows. The marshes are very fertile and verdant from the sewage and the waters are closed to direct harvesting of shellfishing. Many areas

are unsightly because of the solid wastes. In recent times efforts have been made to solve the solid waste disposal problem in an environmentally safe and sanitary manner and with as little aesthetic degradation as possible but it remains difficult. No satisfactory solution has as yet been developed. The problem of preservation of aesthetic qualities in the face of modern packaging and other solid wastes remains to be solved. Sewage for the homes, community buildings and businesses are disposed of directly onto the marshes or into the waters which ebb and flow into them and around the islands.

As important as sound arrangements for disposal of solid and liquid wastes are to Tangier, protection from erosion is equally essential or more so. Erosion is now proceeding at a rate sufficient as to bring about the destruction of two thirds of West Ridge, which is the largest "ridge" in area of the three making up "South" Tangier, the main island on which the town of Tangier is situated. Erosion not only is destroying the very land on which "Tangiermen" depend but it is also adding to the rapid shoaling of Tangier and Pocomoke Sounds and the East and West Channels.

Adding all of these unusual features together causes us to view Tangier as a unique area! One which must be considered from this perspective. Its uniqueness and isolation requires a special approach to the solution of all of the problems referred to above. Many of the alternative technical approaches to solid waste management, disposal of sewage from dwellings and businesses, and reliance on land transportation

are not available to Tangier. By virtue of its island situation and its small diminishing land area, erosion control and land stabilization and land building are especially important.

In developing the analyses provided below and in preparing the recommendations based upon those analyses we have attempted to consider the long-term and mid-term as well as the short-term problems and their solutions. We have kept foremost in mind the needs and desires of the populace and have sought solutions which would do as little damage as possible to the users and uses of the environment and resources and to posterity. Ten generations have used the land and waters of Tangier: Several more probably will. Where there has been an unavoidable conflict between the real needs of the people and the environment (except where survival of the people depends upon that environment), we have recommended in the interests of the people and their needs, as best we can. We believe that the effort has been reasonably successful.

It must be kept in mind that VIMS is a scientific and technical institution whose function is to investigate, analyze and recommend. We must do this to the best of our ability, considering the time, money and other limiting factors involved. In looking at this Tangier Island problem we have had to do the work under a very short time from under severe pressures. Less than a month has been available.

As our review developed it quickly became apparent that no one had taken the trouble to pull all of the relevant

factors together. Often, even as we felt the study was about complete, we learned of impediments such as the "FAA Waiver requirement" that had not been entered into previous efforts. Even as late as the third of January VIMS was informed that sewage disposal on West Ridge is by a series of outfall pipes running directly from the dwellings along the road of West Ridge into the marsh making up proposed spoil disposal site 3. Obviously this new factor (at least to VIMS) had to be considered. Just as obviously the persons or agencies who considered disposal of spoil onto Site 3 prior to the VIMS study had ignored (or were ignorant of) this factor. Several other examples of the difficulties attending our study could be cited. It has been frustrating. Nonetheless we believe that this report which is the first official comment from the Institute on Tangier Island spoil disposal problems, puts forward a reasonable series of recommendations and alternatives. One which will enable the decision makers, who must "factor in" the social and political factors, which VIMS cannot do, and the economic aspects, which we have not been able to encompass in the short period available to us, to make reasonable decisions. VIMS will, of course, assist further in the decision making process in any reasonable way consistent with its responsibilities under Chapter 3, Title 23 and Chapter 9, Title 28 and other applicable sections of the Code.

Using the results of this work, decision should be facilitated. It must be remembered that once spoil disposal sites are identified and approved the Corps of Engineers will

be able to proceed. Part of their work will involve solution of some of the engineering problems attendant to final selection of the spoil disposal site or sites to be finally utilized. They will also settle the engineering problems mentioned herein.

The Analyses

As mentioned above, the spoil disposal problem from maintenance dredging of both the east and west approach channels to Tangier Island must be viewed as a long-term as well as an immediate problem. In addition, the problem of spoil disposal must be considered in the light of the existing rampant erosion on the western shore of the island and the need for solution to the problems of sewage treatment and disposal as well as solid waste disposal. Finally, we must be mindful of the unique cultural and physiographic characteristics of Tangier Island and the fact that the people of Tangier need suitable living and work space.

Up to the present time, dredge spoil disposal for the two channel projects (the West and East Channels) has been on various marshes immediately adjacent to the channels. The principal spoil site, used in the immediate part, East Point Marsh, is under private ownership and no longer available. Those on the island(s) to the north (North Tangier) are owned by the county and presumable remain readily available.

Based upon the above considerations, the information available to us concerning the proposed disposal sites, the

characteristics of the material to be dredged and disposed of, and the engineering requirements of the containment areas, we offer 1) the following analysis of the options, and 2) several ranked recommendations concerning disposal of the materials to be dredged from the East Channel. Insofar as possible the recommendations are designed to provide the various need that have been expressed by the townspeople and by county and state officials and to save time and money while accomodating environmental requirements.

The possible disposal sites which have been considered by the various agencies involved to one degree or another are:

1) Overboard disposal in Tangier Sound--

Although overboard disposal was approved early on by EPA, the Virginia Marine Resources Commission objected due to their concern for its possible adverse impacts on the oyster replenishment program. VIMS, itself prefers, as a matter of policy, that spoil be used as constructively as possible and that it not be placed overboard within Chesapeake Bay or anywhere else in tidal or oceanic waters except where such disposal is the most feasible option--preferably the only option.

2) Previous disposal sites on the north island of Tangier--

Presumably these sites remain as an open option for the Corps since they are owned by the county of Accomac and have been used for this purpose before.

3) Sites 1, 2, 3, 4 and 5 on the south island of Tangier (see Figure 1)--

- a) Site 1 - This site is located behind the new seawall at the south end of the runway. Present plans call for using this site for disposal of material dredged (40,000 cu. yds.) from the West approach channel. When it is filled due care must be taken to assume that necessary drainage of this site and of site 3 will be provided. It is worth noting that the bulk head or rip-rap already constructed to protect site 1 and contain the spoil will be flanked in the not too distant future if protection in the form of suitable bulkheads or rip-rap is not provided on the flank.
- b) Site 2 - This site is located on the western side of the runway. The extent of the site has not been specified in detail, but it could be as large as 17 to 20 acres depending on design and material volumes. The total marsh area west of runway is about 43 acres. Utilization of this site is preferred by the town of Tangier since it is here that they plan development of outdoor recreational facilities (near the north western corner of the air strip) north of the "windsock" and the foundation for a proposed (but yet to be approved) sewage treatment plant which is to be located just below the "windsock". The generalized

site desired by the town for the recreational field is shown shaded in blue in Figure 1.

- c) Site 3 - This site is located between the runway and West Ridge and it is about 18 acres in area. (see Figure 1).
- d) Site 4 - This site, unspecified in area since it has not been seriously considered or measured, is between the West and Main Ridges. (See Figure 1)
- e) Site 5 - This site was examined early by the Corps but removed from consideration as a principal disposal site due to its small size and marginal efficiency when using hydraulic dredging. This marsh now serves as the landfill site (western edge) for solid waste disposal. For various reasons discussed further below, we feel that it should not be ignored since it offers a means of securing more useable high-land adjacent to the flanks which have already been spoiled upon. Furthermore, were the best grade of spoil to be piled sufficiently high it could upon drying then be bulldozed to and around the north and western corner of the runway, thus securing the desired recreational area. This can be done whether or not FAA grants a waiver. (see Figure 1).

We shall narrow our attention to Sites 2, 3, 4 and 5 since overboard disposal has been rejected by VMRC and VIMS does not favor this method of spoil disposal and site 1 is allocated to receive

spoil from the West Channel. The sites on the north island(s) are uncontested and remain open to the Corps should a site allowing for more constructive utilization of the spoil (which we prefer) be unattainable or decided against.

- 1) Site 2 - The natural erosion rate of the western shore of Tangier Island is very marked, being about 20 feet per year. It is a threat to the survival of the dwellings and other improvements on West Ridge including the airfield, as well as to this major land portion of Tangier itself.

The attached aerial photograph (Figure 2) shows the projected shoreline positions for 10, 20 and 30 years in the future. It is apparent that erosion prevention measures will be necessary well within the next ten years if the runway is to continue in operation and if there is to be space for the proposed and essential sewage treatment plant planned for West Ridge. It is also apparent that all of the viable marsh at site 2 will be lost via shoreline retreat within 20 years if erosion is not checked.

The marsh grasses of site 2 are varied. The undisturbed portion north of the "windsock" (about 16 acres) is much more valuable than that to the south of the "windsock" from the viewpoint of productivity. At the present time, the marshes in both portions have good tidal communication which results in uninhibited export of marsh grass detritus and other

nutrients. Foilage area and shelter for marine organisms and wildlife are also provided.

- 2) Site 3 - This area is a poorly drained, stagnant marsh with very few biological values. The poor drainage is due to the existence of the runway construction which has closed off many of the formerly active guts and sloughs. The principal tidal communication is via a very small drain parallel to the south end of the runway. This will be closed when site 1 is filled unless measures are taken to prevent it. Tidal flooding occurs only during extreme tides. Unless extraordinary measures are taken to preserve the limited existing drainage, it is likely that site 3 will become totally isolated from tidal exchange due to the spoil disposal and engineering activities at site 1. This must not be allowed to happen.

Site 3 receives raw sewage and other liquid and solid wastes as a regular course of events. For the dwellings and other buildings on West Ridge this is the only place in which sewage can be disposed of. This use is essential! It must be preserved until the sewage treatment plant is available.

- 3) Site 4 - In spite of the fact that a portion of this area has been used for solid waste disposal by individuals, it remains a productive marsh site

with good tidal communication. Earlier in the island's history, ditches were cut to the houses on Main Ridge so that fuel and supplies could be delivered. These channels are still serviceable for small boat storage and passage. Filling here would interfere with their use, disrupt the marsh and interfere with sewage disposal from the homes on the west side of Main Ridge which discharge their wastes directly into the wetlands and its ditches, sloughs and guts. (see Figure 1).

- 4) Site 5 - This area is a mixed species community composed of the grasses found in the southern and northern areas of site 2. As previously mentioned, the western edge of site 5 is now being used as a site for solid waste disposal. The total area is about 4.5 acres, which is surrounded on three sides by higher land formed mainly by dredge spoil. Further filling would do little environmental damage. (see Figure 1).

To summarize the biological evaluation, we consider site 3 to be the least valuable from the point of view of biological productivity and contribution to the overall ecosystem. We also consider that all of site 5 and the southern portion of site 2 to be of middle rank in these regards. The undisturbed northern portion (north of the "windsock") of site 2 and site 4 are the highest ranked of the sites. The extreme northern end of site 2 has already been modified by filling. Construction of the airstrip has also

caused marsh destructions even beyond the limits of the paved area. This change impinges upon both sites 2 and 3 as well as site 5.

From the long-term point of view, and considering the need for high land within the boundaries of the town of Tangier, we would designate site 3, site 5 and site 2 as spoil disposal areas. This designation is based on the position that as long as marsh must be used as disposal sites (there are no non-marsh sites on either of the islands comprising South Tangier--the town to Tangier), every effort should be made to make constructive use of the spoil.

The rationale for designating site 3 is that it is now a compromised site and it is likely to further be compromised by the planned spoil disposal at site 1.

Site 2, however (about 45 acres in extent, of which 6 acres have already been spoiled upon, should not have any large scale spoil disposal (beyond that mentioned in the recommendations) until the rampant shoreline erosion has been stopped or until a positive plan for protection has been approved with funding identified and reasonable time-table for construction established.

Protection of the western face of West Ridge is of paramount importance since reliable predictions are that a major part of that island, including many of the public and private improvements thereon as well as the wetlands, will be washed away over the next 10, 20 and 30 years (see Figure 2). The recommendations of the Task Force Report for the stone seawall should be followed.

The rationale for the use of site 2, and the qualifier

concerning erosion protection, is as follows:

- 1) Although the sewage treatment plant site has not yet been approved, the suggested site seems the most reasonable with respect to economic and environmental considerations. Placement at that site would involve the coverage of at least 5 acres of marsh and loss of its productivity, other values and amenities. This is not too serious since that part of site 2 is least productive. What is serious is that the site proposed for the treatment facility is in the high erosion zone and is under attack by the waters of the Bay. Protection of the shoreline must be included in this plan. It would be foolish to build a sewage treatment plant in such an exposed location without adequate protection! Approximately 1,200 feet of protection would be required for the treatment plant. The layout for the required protection is shown in Figure 1.

We note that the plan for the treatment plant (Tangier Island, Step 1 Study, Project No. 68-0774 SR by Shore Engineering, Melfa) includes provision of but 400 ft. of shoreline protection. For various sound reasons protection of only such a small portion of the rapidly eroding shoreline would also be foolish!

- 2) At the present rate of erosion, the airport runway will be lost within the next ten years unless the new seawall section at the end of the runway is extended

- by at least 1,400 feet to the north (Figures 1 and 2)
- 3) Since the steps required in items 1 and 2 would sever tidal communication to the marsh south of the "windsock" the biological vitality and productivity values of that wetland will be lost in any event. Subsequent filling of this marsh acreage would be justified in terms of enhancing the integrity of the seawall as well as to prevent stagnant conditions.
 - 4) The shoreline protection which will be required [as described in items 1) and 2) above] would entail riprapping 2,600 feet of the 4,400 feet of shore north of the existing seawall. In order to prevent flanking at the north end of the riprap required for the treatment plant, sound engineering design would call for completion of the seawall all the way to the entrance of the west channel.

Given the unique circumstances of Tangier Island, we feel that filling of the zone north of the "windsock" (about 16 acres) subsequent to installation of adequate shoreline protection, (or commitment to a definite plan for same with funding as presented by the Task Force referred to above) would be justified after filling the area to the south of the "windsock".

The reason we cannot endorse large scale disposal of dredge material on Site 2 prior shoreline stabilization or development of the positive plan, therefore, is that without such stabilization the material will be refluxed to the marine environment as the shoreline is eroded. Much of the eroded material

should simply recycle back into the Tangier channels and harbor. This is due to the fact that the material in the east channel to be disposed of is composed of about 40 to 50 percent silt/clay and most of the sand fraction is fine sand (as opposed to coarse sand which is the most suitable fill for rapid use and erosion resistance). In our opinion, the addition of this type of material to Site 2 would not make a significant contribution to the inhibition of the erosion rate.

On November 16, member of the VIMS Tangier Island Review Team met with representatives of the Norfolk District of Corps of Engineers to discuss and review the factors of the case. The Corps advised us that about 125,000 cubic yards of material will be removed from the East Channel. As previously indicated their rather sparse information on grain size characteristics indicates that 40 to 50 percent of the material is in the silt/clay range and that most of the sand fraction is fine sand.

In their preliminary evaluation of Site 3, the Corps determined that 17 acres would be required to accommodate this amount of spoil with a dike height of 8 feet or greater and a fill elevation of 6 feet above ground level. The Corps has expressed concern about the consequences of dike failure (if filled to the 6 foot elevation) since the fill elevation would then be several feet higher than the runway. To eliminate this hazard, we decided that additional sites were necessary and settled upon Site 2 with or without Site 5, as discussed more fully below, as the most suitable.

The dredged material would be introduced at the north end of the diked area with the fluids spillway on the south end. In the normal settling, the larger grained sand fraction would

remain for the most part in the northern end near the discharge with finer sand and silts settling away from the discharge in the southern end. The town administration expressed concern about the drainage in the area since the Ridge, itself, would be at a lower elevation than the filled area. However, the Corps advises that they would have drainage around the periphery of the dike. (Special Note: We must point out at this juncture that in arranging for this drainage, provision must also be made to accomodate the sewage and other wastes from the buildings in West Ridge now being discharged directly into the periphery of Site 3!)

At that meeting the possibility of using both Sites 3 and portions of Site 2 was discussed with Corps representatives with a view toward developing the most constructive use of the spoil while minimizing the impact on the marshes. The Corps indicates that this approach would permit using a lower dike elevation at Site 3 (dike height of about 6 feet with fill elevation to 4 feet above ground level). The areal requirement at Site 2 would then be about 5 acres. Moreover, they indicate that it would be possible to install a y-shunt in the discharge system so that when relatively clean, large-grain sand is encountered it can be shunted to Site 2. This would emplace the higher quality and more readily usable material at Site 2.

It should be noted that the Corps of Engineers has not performed detailed engineering studies of any of the sites on the south island of the Tangier Island Group and that their estimates of the volumes removed are based upon surveys of April 1976. Presumably more complete engineering information will be obtained and made available after designation of the spoil sites.

We have learned during the course of this investigation that there are formal restrictions by the FAA on penetration of runway air space by structures (including dikes or spoil areas) which must be considered. These restrictions (subject to waiver) for Tangier are as follows:

1. No obstacles may penetrate the plane coincident with that of the runway elevation (6.4 feet above MLW) for a distance of 212 feet on either side of the runway and within 200 feet at the north end of the runway. This boundary is shown in red in Figure 1.
2. At the limit of the above boundary no obstacles may penetrate the plane inclined at a slope of 1 in 7 extending to a height of 150 feet. Thus, at a distance of 14 feet from the aforementioned boundary delineated (in red), a dike 2 feet higher than the runway would be permitted; at a distance of 28 feet, a dike 4 feet higher than the runway would be permitted. Inspection of Figure 1 shows that more than one-half of Site 3 falls within the restricted zone as does most of the area in Site 2 desired by the town for the recreational facility.

The Recommendations

With the above facts and analyses as background we offer the following recommendations for the immediate disposal problem:

Recommendation I

We recommend that temporary waivers be requested from the FAA to permit the penetration of the runway airspace by temporary earth dikes higher than the runway elevation. Conversa-

tions with the Corps indicate that a 90-day waiver would probably suffice for construction, filling and initial dewatering, following which the dike elevations could be graded to conformity with the regulations. (The time of the waiver should be adequate to allow for all reasonable contingencies!)

If a waiver can be secured, then our recommendation is that:

- A. Site 3 be utilized as the principal site. Its use would have to be subject to any limitation imposed by the Virginia Airport Authority. Part of these limitations should include an engineering evaluation of the effect of possible lateral displacement of the marsh substrate due to overburden pressure and consequent movements of the foundations of the runway and the homes on West Ridge. It would not be wise to allow the runway surface or buildings on the Ridge to be displaced or damaged by poorly planned and conducted spoil disposal. Existing boring logs from the Airport Authority indicate that the marsh horizon is only several feet thick and that it contains appreciable fine sand. Under these conditions, we do not expect the problem to be severe, but it must be explicitly examined!

In the course of filling this area, the northern end of the site would contain the sand fractions and would be the earliest usable acreage in this site. In passing, it might be noted that this area should also be evaluated by the town for its recreational facility or for other uses. The

need for adequate drainage to protect the buildings on West Ridge and allow for proper drainage of the ground and for sewage disposal as now practiced has already been mentioned above.

- B. That portions of site 2 be used for disposal of the remainder of the material (Figure 1--area shown by the right and downward slanted hatching) utilizing a Y-shunt to permit the use of the higher quality material. To the extent possible, the existing spoil areas to the north and immediate west of the runway should be increased in elevation. The fill should not extend beyond the zone marked in Figure 1 which will preserve the present tidal communication in the system. The delineated configuration in Figure 1 will supply the required area estimated by the Corps to be needed in addition to site 3. Approximately one-half of the area has already been disturbed by previous spoil activities accompanying construction of the runway.

As noted earlier, the above combination would require dike elevations in site 3 which would extend above the runway elevation by 2 to 3 feet. The ground elevation of site 3 is about 2 feet (MLW). Thus a 6 to 7 feet dike added on top of that would extend above the runway elevation (6.4 ft., MLW) by 2 to 3 feet.

Recommendation II

The Corps of Engineers has advised us that site 3 would not be a suitable site for disposal if an FAA waiver cannot be obtained. They explain that this is due to the fact that the

resulting containment volume would be so small that they would not achieve adequate settling of the finer grained materials. If the appropriate waiver cannot be obtained we recommend that following course of action, provided a positive plan for protection of the entire western shoreline of the South Island (West Ridge) is approved, with construction of the shoreline protection facility scheduled within 3 to 5 years after spoil disposal:

- A. Use approximately 16 acres of site 2 for spoil disposal. The boundaries (shown in Figure 1, hatching slanted down and to the left) include about 16 acres with a fringe of undisturbed marsh which is allocated as a buffer so that the spoil will not be refluxed into the marine environment prior to stabilization of the shoreline, if carried out as recommended above.

Although this plan would supply fill for the sewage treatment plant site, positive verification of the suitability of the fill for this purpose should be obtained from engineers familiar with such plants. If it is not, then the spoil should be placed on the north island sites behind suitable dikes. Obviously it would be unwise to put spoil unsuitable to the requirements of the sewage treatment plant in site 2.

- B. A request should be made to the Corps of Engineers to reconsider site 5 as a disposal site for emplacement of the sandy spoil. If this site could be used and appropriately filled with adequate sandy spoil then the town could transfer the material, when dry, to the area desired for the recreational facility which,

as we understand it, would be at the western side of the north end of the runway.

- C. The remainder of the spoil material should be placed in the sites on the north island, suitably diked.

Recommendation III

If an FAA waiver cannot be obtained to permit carrying out of the proposal presented in Recommendation I, and no positive plan can be developed for shoreline stabilization (Recommendation II) we then recommend:

- A. That the Corps of Engineers be strongly requested to reconsider site 5 as a disposal site for emplacement of the sandy spoil in suitable volume and consideration so that the town could transfer the material, when dry, to the area desired for the recreational facility.
- B. That the remainder of the dredged material be emplaced on the previously used sites on the north island(s) behind suitable dikes.

The solutions offered will, in our collective opinion, permit the constructive use of the spoil in this unique island situation while avoiding unnecessary destruction of the marshes, or refluxing of the dredged material to the marine environment and minimizing disruption or interruption of existing and planned structures.